or even tertiary. To refer it to the latter age would not, however, help the hypothesis here discussed, since there is no evidence whatever of its being of marine origin, and its northward extension well into the heart of central Brazil makes it embrace a very considerable portion of the Archamazonia faunal region of Dr. von Ihering.

The heavy trap dykes and sheets of this formation give very marked topographical features (lines of escarpments and obstructions in rivers) by which it can be traced even in regions that have not been geologically examined, and for some years I have occupied myself in tracing its distribution through such chance information and specimens as were obtainable from regions not personally known to me. Particularly valuable for this purpose was the material which for years has been accumulating in the Museum National of Rio de Janeiro and which for the region under discussion is especially important and authentic, since it contains a complete duplication of the material collected by Sellow on which Weiss' paper, the most important that has yet appeared on the geology of Rio Grande do Sul and Uruguay, was based. Without going into detail, suffice it to say that there is evidence that I consider sufficient to establish the general fact that this formation extends without a break and in the form of a great tableland, from 600 to 1,000 meters high, from near the headwaters of the Paraná in southern Goyaz and western Minas Geræs to the line of escarped hills that cross nearly in the middle, the State of Rio Grande do Sul from east to west. To the south of this line, which seems to be a giant fault, the formation lies lower and has been much denuded, so that it is frequently interrupted by areas of older rocks appearing from underneath, but thus far no evidence whatever has been presented of the occurrence of any overlying formation of marine origin.

Of special significance for our present purpose is the fact that the falls and rapids of the river Uruguay, down to the Brazilian limit and beyond, are composed of the hard traps of this formation which would thus present a barrier to the sea which in tertiary times undoubtedly occupied a part of the Argentine province of Entre Rios. The only point where the deposits of this sea are known to extend to the eastern bank of the Uruguay is near the town of Colonia, too far south to suit the hypothesis here discussed. Topographically considered, the only line in which there was a possibility of a break across this barrier is a depressed area in front of the above mentioned line of escarpments, occupied by parts of the valleys of the rivers Ybicuhy, flowing westward to the Uruguay, and Jacuhy, flowing eastward to the Atlantic. These two valleys are, however, separated by a considerable spur that unites like an isthmus the highlands of the upper Uruguay basin with those of southern Rio Grande do Sul and Uruguay. Thus far no evidence has been presented that this isthmus was ever submerged, or that the depressed portions of the Ybicuhy and Jacuhy valleys are occupied by other than fluvial deposits. It is quite possible that in secondary or tertiary times an arm of the sea may have extended into the region of the lower part of the present Jacuhy valley, but if so there is slight probability that it extended westward into those of the Ybicuhy and Uruguay, and even if such a connection be admitted it could only have been a narrow strait quite incapable of producing the 'collosal' faunal difference that it is attempted to explain. Speculation as to the probable existence of this strait is, moreover, quite gratuitous, since, if I rightly understand Dr. von Ihering, its position is entirely within his Archiplata sub-region.

ORVIILLE A. DERBY.

SÃO PAULO, BRAZIL,
Jan. 8, 1901.

GEOLOGICAL MAP OF EUROPE.

WHAT has become of it? Why does Dietrich Reimer not publish it?

WM. A. INGHAM,
Ex-Secretary Penna. Geol. Survey.

NOTES ON INORGANIC CHEMISTRY.

ROCK FORMATION.

AN important contribution to the study of solid solutions has been made by Professor W. Spring in the *Revue Générale des Sciences*, under the title of 'The Plasticity of Solid Bodies and

its Connection with Rock-Formation.' Experiments were carried out to determine whether under the influence of great pressure solid particles, which do not under ordinary circumstances unite, might be made to cohere. The pressure used in the experiments was about 10,000 atmospheres, and this pressure could be exerted if necessary at a temperature as high as 400°. All bodies which are plastic under pressure were found to cohere as if they had been fused, while those substances which are not malleable remained in a powder after exposure to the greatest pressures. Thus sand, calcium carbonate, alumina and oxid of iron did not cohere, and since the pressure used corresponds to a column of sand fifty kilometers in height, pressure alone can not be the cause of the formation of rocks from these materials. Metallic powders, on the other hand, cohere perfectly, which must be due to a kind of solid solution. That this is probable is shown by using mixtures of different metals, in which case alloys are formed as perfectly as by fusion. Those metals, however, which do not alloy by fusion, as lead and zinc, will not alloy under pressure. That these alloys were not occasioned by a mere mixing under pressure was shown by placing together without pressure cylinders of the same and of different metals. Even in the cold there was some adherence and, when heated to a temperature far below the point of fusion, a perfect union was obtained in a few hours. In the case of the union of different metals, an alloy was formed at the line of junction, which with tin and lead was six millimeters in thickness. Compounds were readily formed by pressure in those instances where the volume of the compound is less than that of its constituent elements, as with silver and sulphur; on the other hand, compounds which occupy more space than their constituents were dissociated by pressure. Thus copper calcium acetate was decomposed into copper acetate, calcium acetate and water. In those cases where solution is accompanied by contraction, the presence of water was found to greatly assist in the formation of solid masses from the powders, and solid carbonates were readily formed. A solution of silicic acid alone did not cause agglutination of sand, owing to the great contraction on drying, but when combined with even low pressure, solidification to a considerable extent was obtained. All these influences have played a part in rock formation.

ARSENIC IN COPPER.

Little is given in chemical literature regarding the effect of small quantities of arsenic upon copper, a subject of much importance at the present day. A series of experiments is described by Ernest A. Lewis in the *Chemical News*, in which arsenic was added to a copper 99.843 per cent. pure, and the resultant metal studied photomicrographically and as to its physical properties. Malleability is not appreciably affected by small quantities of arsenic (up to 1.8 per cent.), the samples with 1 per cent. and with 1.37 per cent. rolling particularly well. The tensile strength is from 3 to 5 tons higher than that of ordinary sheet copper, the limit of elasticity is about 3 tons per square inch higher, and the elongation is not reduced. From micrographical examination, the metal appears to consist of crystals of copper, in a eutectic of copper arsenid or a solution of copper arsenid in copper. In copper intended for rolling, except that for electrical purposes, the presence of a small amount of arsenic appears to be a distinct advantage, but nothing is gained by having more than 0.5 per cent. present.

ATMOSPHERIC HYDROGEN.

An interesting result of Professor Dewar's latest experiments, in conjunction with Professor Liveing, on the more volatile of the inert gases of the atmosphere is the demonstration that hydrogen exists free in the atmosphere in sensible proportion. There has been much question in the past as to its presence, which has not been heretofore satisfactorily proved; indeed the velocity of the hydrogen molecule renders it doubtful as to whether hydrogen would not escape from the earth into interplanetary space. On this basis there must be a continual accession of hydrogen to this planet from the interplanetary space, and hence possibly of the elements which occasion the lines of the nebular and coronal spectra. Some indications in this direction have been found in the atmospheric inert gases, and these are now being studied from this standpoint. J. L. H.